the viewpoint of better spin filter effect, the layer is preferably oriented in fcc(111) so as to reduce the resistance. However, a microcrystalline or amorphous free layer of CoFeB is also employable.

Ms of the simple CoFe free layer is larger than that of NiFe. Therefore, for realizing the same degree of MsXt, the CoFe layer could be thinner than the NiFe layer. From the view point of the spin filter effect, the simple CoFe free layer is preferred. For example, for realizing a free layer of 4.5 nanometer Tesla, NiFe/CoFe must be 3.6 nm NiFe/0.5 nm CoFe, and its total thickness is about 4 nanometers. As opposed to this, the thickness of the simple CoFe free layer could be 2.5 nanometers. The latter is thinner by about 1.5 nanometers than the former, NiFe/CoFe. Where a high-conductivity layer is provided below the free layer of the two films, the down spin electrons will be filtered out, since they are thick as compared with the mean free path for down spin of about 1 nanometer. However, at a total thickness of around 4 nanometers of NiFe/CoFe, the mean free path for down spin will be near to that for up spin. In that condition, the underlying high-conductivity layer will produce a simple shunt effect. Therefore, increasing the high-conductivity layer thickness causes MR reduction owing to the shunt effect.

On the other hand, for the simple CoFe, the mean free path of up spin is longer than 2.5 nanometers. Therefore,

providing a high-conductivity layer of which the thickness is not so large will results in the increase in the mean free path for up spin, thereby increasing MR. In experiences and through experiments, it is known that, where Cu is used for the high-conductivity layer, MR peaks appear when the total thickness of the Cu layer and the free layer of NiFe/CoFe or CoFe is 4 nanometers or so, or falls between 3 nanometers and 5 nanometers. In other words, when the high-conductivity layer that is necessary for bias point designing is relatively thick, NiFe/CoFe rather causes MR reduction owing to the shunt effect but not to the spin filter effect, while, on the other hand, CoFe satisfies both good bias point control and MR increase owing to the spin filter effect. Therefore, CoFe is advantageous. This is because, as so mentioned hereinabove, the MR peaks depend on the total thickness of the high-conductivity layer and the free layer. Therefore, when the CoFe layer thickness is smaller, then the Cu layer thickness to give MR peaks shall be larger, and the spin filter effect and the bias point control both could be augmented. For the reasons mentioned above, the simple CoFe free layer is preferred for spin valve films.

The thermal stability for MR of the laminated NiFe/CoFe free layer is worse than that of the simple CoFe free layer, and the simple CoFe free layer is better, as producing large MR.

The simple CoFe free layer is still better than the ultra-thin, laminated NiFe/CoFe layer, as its magnetostriction control is easy. In particular, the interfacial magnetostriction is important in ultra-thin free layers. Therefore, NiFe/CoFe is inferior to simple CoFe, as the former shall have one additional interface.

The bias point in the constitution of (8-1) could fall within a good range of from 30 to 50 % or so, as in Example 1. Also like in Example 1, the MR height dependence of the free layer in (8-1) is small.

Regarding the MsXt dependence of the free layer, smaller MsXt gives smaller saturation magnetization Hs on the transfer curve, and requires severer bias point control. Concretely, much reducing the current magnetic field is important, and increasing the high-conductivity layer thickness is needed. As previously mentioned hereinabove, in the spin valve films of the invention, the thickness of the high-conductivity layer capable of producing MR peaks owing to the spin filter effect shall be larger with the reduction in the thickness of the free layer. This well matches with the constitution of this Example. It is understood that the idea of designing the spin valve films of the invention is favorable to heads for high-density recording.

Concretely, when MsXt of the free layer is 4.5 nanometer Tesla and the thickness of the CoFe film is 2.5 nanometers,